

## Low-background Counting Facilities

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The LBNL Low Background Facilities (LBF) consist of a Berkeley site and an Oroville site specially configured for low-background gamma-ray spectroscopy. The Berkeley site was established in 1963 and consists of a 3m by 7m x 3m room surrounded by 1.6m of specially-selected low-background concrete shielding. The aggregate in this concrete is from serpentine gravel which is low in U, Th, and K. This barrier was made to shield against accelerator-produced neutrons and natural gamma radiation as well as some cosmic rays. Also, the low-activity concrete emits little radon, and a HEPA-filtered air system constantly purges the room to reduce airborne radon.

Detectors at this site include a 20 cm diameter by 10 cm thick NaI crystal, two 30% p-type Ge spectrometers (one of these with an external active cosmic ray suppresser), an 80% p-type Ge spectrometer and a 55% n-type spectrometer suitable for low-energy gamma-ray and X-ray measurements. These detectors each have small local shields consisting of 10 cm of Pb. The overall shielding reduces background to the point where internal activity in the detectors and cosmic-rays are the dominant source of background.

The LBF Oroville site is located in the powerhouse of the Oroville Dam, under 180 m of rock cover. This site now has a 115% n-type and a 30% p-type Ge spectrometer and is used for our most sensitive counting. Sensitivities of 50 parts-per-trillion (PPT) for U and daughters, 200 PPT for Th and daughters, and 100 parts-per-billion for K are realized at the Oroville site.

The LBF has been involved in a wide variety of experiments supporting programs from LBNL and a variety of other institutions. There are five main types of work the facility supports: 1) low-activity materials certification, 2) neutron activation, 3) nuclear science experiments, 4) cosmic ray activation, and 5) environmental health and safety activities.

The ongoing materials certification work for SNO and the UCB Dark Matter is nearing its end, although it is expected to be replaced with

“work for others” certification of low activity industrial materials important in semiconductor manufacture.

Neutron Activation Analysis work is focused toward measuring the solubility of various metals in Silicon, again, significant for the semiconductor industry. This work is ideally suited to the sensitivity available at the LBF ( $10^{12}$  to  $10^{16}$  atoms/cm<sup>2</sup>). Work is starting with biological and plant samples and is expected to include studies of the uptake of metals in bacteria.

Cosmic-ray activation work has been limited to a few samples returned to earth from MIR and other satellites. Unfortunately, parts expected from the HST never arrived.

The facility supported some aspects of the Nuclear Astrophysics Group mainly looking for minute Na-22 activity in a Mn-54 source.

A substantial amount of the facility's time was (and still is) involved with Environmental Health and Safety work. This includes the characterization of a large number of “pit room” samples, some of which will be kept for their unique transuranic isotopes, and some of which will be disposed of. A significant effort also went into the characterization of HEPA filters to develop a protocol for disposal. This protocol was accepted by Hanford. The LBF was involved in additional “field” measurements, including characterization of waste samples at Bldg. 75 and neutron field measurements in building 70. Additional field work is expected at the former BEVALAC.

During the coming year, science projects are expected to replace some of the EH&S work. New projects screening materials for semiconductor manufacturing are proposed, including both direct counting and neutron activation, and work in support of bioremediation is expected to accelerate. The pit room work will be completed and a 6-12 month HEPA characterization program will proceed.